

What Every Teacher Needs to Know About Utilizing

Discovery Learning in the Classroom

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*The beginning of knowledge is the discovery of something we do not understand.*

Frank Herbert <sup>1</sup>

Discovery learning has been the source of some controversy since its introduction to the pedagogical world. Based on the constructivist methods of instruction, discovery learning is encouraged because it allows students to learn information through exploration rather than having an instructor directly relay the material to the class. Constructivist methods of instruction are founded on the principle “that learning is an active process in which learners are active sense makers who seek to build coherent and organized knowledge” (Mayer, 2004, p. 14). Thus, these methods are essentially discovery-oriented. The controversy that arises, however, is over the level of structure and guidance applied to the discovery learning process and the effect that it has on the understanding of emphasized concepts, principles, and approaches. The intent of this article is to engage in the debate by examining how discovery learning works, its uses in the classroom, and finding the best means of incorporating discovery learning to achieve the active engagement of students in the learning environment.

The discovery lesson model is one in which students discover the lesson objective in a unifying manner rather than as individuals. It employs inductive reasoning, which is the ability to reach objectives through answering leading questions or being shown examples and nonexamples (Price & Nelson, 2007, p. 169). In another of its forms, discovery learning is

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<sup>1</sup> Herbert, F. (2007, November 25). Quote Details: Frank Herbert. *The Quotations Page*. Retrieved from <http://www.quotationspage.com/quote/26173>.

employed in an inquiry-based manner through which students observe and perform the genuine methods of making a discovery.

With both of these forms, there is a varying level of instructor support. Studies have found that the best type of support that the instructor can provide is interpretive support. According to Swaak, de Jong, and van Joolingen (2004), “interpretive support activates the students’ prior knowledge and intends to enhance problem representations” (p. 233). By gauging the amount of support that the students require, whether it is step-by-step guidance or minimal outside intervention such as hints, coaching, and scaffolding, instructors can teach students the means to regulate the processing of information for themselves in order to understand their own progress.

The principal use of discovery learning should always be an academic one, specifically because it can be used to teach ideas and theories in any content area. “Discovery learning is most noticeable in problem solving situations. The learner calls on their past experience and prior knowledge to discover the new information or skills. It is a personal, internal, constructivist-style learning environment” (Bardin, n.d., ¶ 3). However, discovery learning can even be used to make material, such as rules and theorems, more interesting and motivating for students. An instructor also might choose discovery learning to encourage higher level thinking skills to be used by students, which is essential for students to have the opportunity to develop. The final use of discovery learning is to improve students’ abilities to retain and transfer the information that they learn. “Students may be more apt to recall what they have learned when they have been given the opportunity to figure out something for themselves” (Price & Nelson, 2007, p. 170). In the following paragraphs, these uses of discovery learning will be examined.

When utilizing discovery learning in the classroom in problem-solving situations, the types of assignments created can be relegated to these five categories defined by de Jong et al. (1998): do-it assignments, investigation assignments, explication assignments, specification assignments, and optimization assignments (p. 237). In a do-it assignment, students are given a general task to explore a topic; they are given no specific direction to work towards in this type of task. An investigation assignment asks that students examine the interactions between two or more given variables. Explication assignments have a baseline or sets of initial conditions at which the task begins and students are to then monitor the impact of those conditions as the experiment progresses. Afterward, students are presented with a list of explanations of the phenomenon or phenomena observed and are to identify the correct response. In a specification assignment, students are required to predict what will occur when the experiment ends based on what they already know. Finally, optimization assignments ask that students change the worth of the experiment's variables in order that the specified limitations are not exceeded and the goal given at the beginning of the task is met.

In creating these models, de Jong et al. (1998) allowed for an instructor to arrange assignments that help students plan their own discovery process (p. 237). Using assignments can assist the students in choosing the next step and may help guide students to identify and apply all of the related features of a topic. Discovery learning is great for building up students' problem-solving skills, particularly since it is important for students to acquire those strategies in order that they will be less inclined toward defeatist attitudes when dealing with new material.

Additionally, the value of making the material presented more enticing to students should not be underestimated. "Students learn more when instruction is delivered in a way that engages the total student" (Foster, 1996, p. 34). Discovery learning is ideal for this because it invites a

hands-on approach to understanding the presented material as well as a means of engaging in an exploration of a topic that connects to their prior knowledge base.

It is necessary for students to develop higher level thinking skills in order to reason logically and problem solve. Discovery learning is a means of providing the opportunity for that growth. Mayer (2004) notes that

[It] is effective because it helps students meet two important criteria for active learning—

(a) activating or constructing appropriate knowledge to be used for making sense of new incoming information and (b) integrating new incoming information with an appropriate knowledge base. (p. 15).

In a guided format, discovery learning is an essential tool in fostering students' active learning into an evaluation of the material that they are presented and producing a full understanding of the topic.

The final use of discovery learning should be for students to retain and transfer the information that they have learned. In his article, Foster (1996) asserts the importance of fully engaging students in the discovery lesson by requiring them to describe the progression of their ideas as they work to complete the task (p. 35). This method not only advances student learning, but additionally will increase the retention and transfer of the knowledge obtained during the lesson. Foster further states that both students and instructors can use simple inquiry methods to assist in processing the knowledge related to the task, in order to sum up what they are experiencing. Questions that will facilitate the progression of ideas during a discovery lesson (Foster's "think-aloud protocol") include:

1. How do you think you should begin?
2. What information will you need and how will you get it?

3. What does the information you have been given mean?
4. What is your hypothesis about how that works?
5. What happened as a result of your action?
6. How does that impact your hypothesis?
7. Based on what has happened so far, what have you learned about the task/problem?
8. When you do that, what do you think is going to happen?
9. What should you do next? Why?
10. Is this like anything you have done before? (Foster, 1996, p. 35).

By utilizing these questions during a discovery lesson, the instructor not only has students articulate their thought processes, but facilitates the development of skills in inquiry that students will be able to apply in order to help themselves and others to problem solve.

Discovery learning is a valuable asset to instructors simply for the variety of topics that it can be used to teach. However, discovery learning is not always the best means of learning new material. The instructor must evaluate the content of a lesson carefully to determine if using discovery learning is the best means of teaching the material to the students. Discovery learning should never be applied to material that presents a safety issue, such as proper lab usage. It also should not be used when there is a strong likelihood that students will fail to discover a procedure, especially if there is a right way to accomplish the objective and many ways to get it wrong; it will just frustrate students and impede their future attempts at problem-solving. Also, discovery learning is not a good means of studying the material if the process to do so takes a long time because it decreases the value of the experience of making the discovery while simultaneously increasing students' frustration levels.

In conclusion, discovery learning is a means through which to achieve the active engagement of students in the learning environment. Though it is not the best choice of lesson delivery in every context, it stands out due to its myriad opportunities for students to develop higher level thinking skills, including problem-solving and learning to facilitate the progression of their own ideas in order to become critical thinkers.

### **For Further Reading**

Hammer, D. (1997). Discovery Learning and Discovery Teaching. *Cognition & Instruction*. 15(4), 485-529. This article discusses the merits of not only employing discovery learning in the classroom, but being a “discovery teacher” in order to explore student understanding and gauge individual progress.

Prince, M. & Felder, R. (April 2007). The Many Faces of Inductive Teaching and Learning. *Journal of College Science Teaching*. 36(5), 14-20. This article examines the efficacy and performance of different inductive teaching methods, including inquiry-based learning, problem-based learning, project-based learning, case-based teaching, discovery learning, and just-in-time teaching.

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